IN THE DRAWINGS:

Submitted herewith is a replacement drawing sheet containing Figs. 3A-3B and in which Fig. 3A has been revised to add a third pressure control valve 24, which is described on page 31 of the specification.

REMARKS

In the last Office Action, claims 1-2 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,867,658 to Sugita et al. ("Sugita"). Claims 3-10 were objected to as being dependent upon a rejected base claim and were otherwise indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The drawings were objected to under 37 C.F.R. §1.83(a) as failing to show "a third pressure control valve" as recited in claims 9 and 10, and the Examiner required either amendment of the drawings to show the third pressure control valve or deletion of this element from the claims.

The Examiner acknowledged applicants' claim for foreign priority under 35 U.S.C. §119, and acknowledged receipt of the priority document, thereby perfecting the foreign priority claim.

In accordance with this response, original claims 1-10 have been amended only in editorial respects to better conform the claim wording to U.S. practice. The specification has been likewise revised in editorial respects and to correct minor informalities. New claims 11-20 have been added to provide a fuller scope of coverage. Fig. 3A of the drawings has been revised to add the third pressure control valve 24,

which is recited in claims 9 and 10 and described on page 31 of the specification. To effectuate this change, a replacement drawing sheet containing this revision has been submitted.

A new, more descriptive abstract has been submitted.

The present invention pertains to gas compressors of the vane rotary type in which vanes slide in vane grooves in a rotor while sliding along an elliptical surface of a cylinder to form variable volume compression chambers for intaking, compressing and discharging refrigerant gas.

As shown in Fig. 8 of the application drawings, during normal operation of such a compressor, when the rotor 4 rotates, the vanes 17 are urged outwardly into sliding contact with the elliptical cylinder wall by centrifugal force and by back pressure exerted on the base of the vanes by compressurized lubricant supplied to the vane groove bottom portions 16a via a flat groove 11. Near the completion of the compression cycle of the refrigerant gas in the compression chambers 5a, the pressure of the compressed refrigerant gas increases dramatically and tends to urge the vanes 17 rearwardly toward the vane groove bottom portions 16a. To compensate for this phenomenon, a high pressure supplying hole 10 is disposed to communicate with the vane groove bottom portions 16a immediately prior to the compressed refrigerant

gas being discharged from the compression chamber 5a, and the high pressure of the lubricant supplied to the high pressure supplying hole 10 is added to the vane back pressure in the vane groove bottom portions 16a to forcefully urge the vane 17 outwardly so that the vane tip is maintained in sliding engagement with the elliptical cylinder wall.

Applicants have discovered, however, that during start-up of the compressor, the rotor 4 often rotates at a low speed, which reduces the centrifugal force applied to the vanes 17. If the centrifugal force is too low, the vanes will not be maintained in sliding contact with the elliptical cylinder wall resulting in incomplete formation of the compression chambers 5a. Moreover, during the start-up operation, the pressure of the refrigerant gas in the exhaust chamber 6 may be too low to pressurize the lubricant to the degree necessary to supply sufficient lubricant to the flat groove 11, resulting in a reduction in the vane back pressure which can also cause the vanes 17 to not be maintained in sliding contact with the elliptical cylinder wall. As a consequence, it takes an undue length of time to define the individual compression chambers 5a, thereby deteriorating the compression performance at the start of operation of the gas compressor.

To overcome these drawbacks, applicants have devised a compressor, in which during start-up of the compressor, refrigerant gas compressed in the compression chambers 5a during the suction/compression process and which leaks past the vanes 17 into the vane groove bottom portions 16a, is used to increase the vane back pressure of other vanes. As shown in Fig. 8, as the vane groove bottom portions 16a moves out of communication with the flat groove 11, the vanes 17 further retract into the vane grooves 16 as the compression cycle nears completion, thereby further compressing the refrigerant gas confined in the vane groove bottom portions 16a. As the rotor 4 continues to rotate, the vane groove bottom portions 16a come into communication with the high pressure supplying hole 10, whereupon the compressed high pressure refrigerant gas is discharged into the high pressure supplying hole 10 and delivered to the flat groove 11 through a communication passage 21 which, as shown in Figs. 2A-2B, is comprised of a first supplying passage 12 and a second supplying passage 14. In this manner, the high pressure refrigerant gas discharged into the flat groove 11 increases the vane back pressure of other vanes 17 whose vane groove bottom portions 16a are in communication with the flat groove 11. Thus, at the point in time when high pressure refrigerant gas is discharged into the flat groove 11, other ones of the vane grooves 16 are in

communication with the flat groove 11, and the high pressure refrigerant gas is discharged into the vane groove bottom portions 16a which are in communication with the flat groove 11.

In this manner, in addition to the centrifugal force and the pressure of the lubricant supplied to the vane groove bottom portions 16a through the flat groove 11, the pressure of the high pressure refrigerant gas discharged into the high pressure supplying hole 10 is applied via the flat groove 11 to the vanes 17. By such a construction, the vanes 17 are forcefully pressed against the elliptical cylinder wall thereby quickly dividing the cylinder chamber 5 into the compression chambers 5a.

Independent claim 1 is directed to a rotary vane compressor and recites, inter alia, a flat groove configured and arranged to communicate with vane groove bottom portions during a refrigerant gas sucking/compressing process, a high pressure supplying hole configured and arranged to communicate with the vane groove bottom portions upon interception of the communication between the vane groove bottom portions and the flat groove in the refrigerant gas compressing process, and a communication passage for establishing communication between the flat groove and the high pressure supplying hole at the start of operation of the gas compressor. No similar structure is disclosed or suggested by Sugita.

Sugita discloses a rotary vane compressor having flat grooves 22, 23 which are connected through holes 20, 21 and holes 14, 15 and 16 to a source of lubrication oil 8. The holes 20, 21 are not high pressure supplying holes as stated in the rejection, but rather are holes for flowing the lubrication oil at reduced pressure from gaps or clearances between the bearing portions 2a and 3a of the side blocks 2 and 3 and the rotor shaft portion 5a. See column 2, lines 34-48. Thus the holes 20, 21 are not high pressure supplying holes but rather are, as explicitly stated in the reference, low pressure supplying holes for supplying lubrication oil at reduced pressure to the flat grooves 22, 23.

Moreover, claim 1 requires that the high pressure supplying hole communicate with the vane groove bottom portions "upon interception of the communication between the vane groove bottom portions and the flat groove." As clearly shown in Figs. 5a and 5b of Sugita, the holes 20, 21 continuously communicate with the vane groove bottom portions whenever the vane groove bottom portions are in communication with the flat grooves 22, 23 and not, as required by claim 1, upon interception of the communication between the vane groove bottom portions and the flat groove. It is, therefore, clear that the holes 20, 21 of Sugita do not correspond to the high pressure supplying hole of claim 1.

Sugita does disclose a high pressure supplying hole 24 (Figs. 4 and 5b) which communicates with the high pressure hole 14 for supplying high pressure lubrication oil to the vane groove bottom portions to temporarily increase the vane back pressure in the region where the compressed gas is expelled from the compression chambers. See the paragraph bridging columns 2-3. The high pressure supplying hole 24 is situated to communicate with the vane groove bottom portions <u>after</u> the compression chambers discharge the compressed gas and at a time when vane chatter is most likely to occur. The high pressure supplying hole 24 is provided to control the pressure between the vanes and the cylinder inner wall in a preferable condition by applying high pressure oil to only the chattering portion of the vanes during normal running operation of the compressor. See, for example, column 2, lines 13-19. In contrast, the high pressure supplying hole 10 of the inventive compressor is situated to communicate with the vane groove bottom portions <u>before</u> the compressed gas is discharged so that the high pressure refrigerant gas which leaks past the vanes 17 into the vane groove bottom portions 16a can be delivered through the communication passage to the flat groove 11 to assist in urging other vanes into sliding contact with the elliptical cylinder wall to quickly establish the compression chambers 5a during start-up of the compressor.

Lastly, it is not seen where Sugita discloses any communication passage corresponding to the communication passage recited in claim 1. The rejection states that Sugita discloses a communication passage (not numbered though clearly shown in Fig. 4) adapted to establish communication between the flat groove 22, 23 and the high pressure supplying hole 20, 21 at the start of the gas compressor. This is not understood since as clearly shown in Fig. 4, the flat grooves 22, 23 communicate directly with the holes 20, 21, and thus there is no communication passage for establishing communication between the grooves and the holes. In any event, Sugita does not disclose a communication passage for establishing communication between a flat groove and a high pressure supplying hole at the start of operation of the gas compressor, as required by claim 1.

For the foregoing reasons, applicants respectfully submit that Sugita does not disclose or suggest the gas compressor recited in independent claim 1 and dependent claim 2. Moreover, there is no teaching or suggestion in Sugita that would have motivated one of ordinary skill in the art to modify the Sugita gas compressor to replicate the gas compressor recited in claim 1. Therefore, reconsideration and withdrawal of the rejection of claims 1-2 are respectfully requested.

Applicants respectfully point out that claim 1 has not been amended in any substantive respect but rather has only been amended in minor formal respects. Therefore, should the Examiner propound a new ground of rejection against claim 1 in the next Office Action, applicants request that the action not be made final as such new ground of rejection has not been necessitated by any claim amendments made by applicants.

New claims 11-20 correspond respectively to claims 1-10. Independent claim 11 recites the structure of the gas compressor in a somewhat different manner than claim 1, though claim 11 includes the groove, high pressure supplying hole and communication passage recited in claim 1 and thus patentably distinguishes over Sugita for the same reasons as does claim 1. Claims 12-20 depend on claim 11 and are therefore likewise patentable.

In view of the foregoing, the application is now believed to be in allowable form. Accordingly, favorable reconsideration and passage of the application to issue are most respectfully requested.

Respectfully submitted,

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MAILING CERTIFICATE

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November 8, 2004
Date